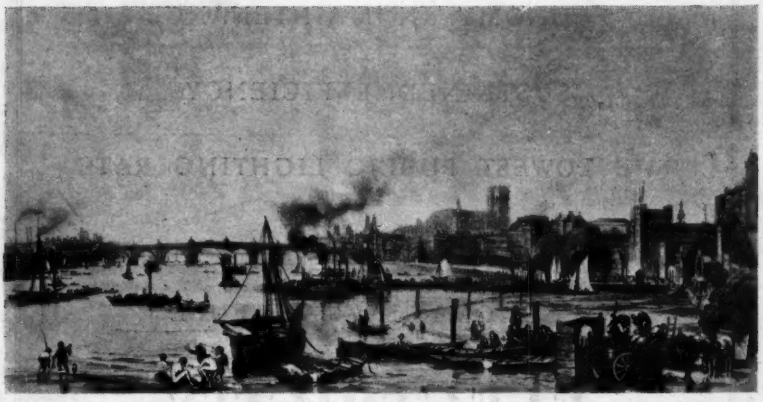
Light and Lighting

Vol. XLI.—No. 1 January, 1948 Price: One Shilling



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The Changing Scene

To meet the needs of modern life London's river-frontage has altered vastly in a hundred years, as can be seen from this view of Westminster and Hungerford from Waterloo Bridge in the eighteen-forties. Developments have constantly occurred, not the least being the lighting of its broad embankments.

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A New Year Begins

THE forty-first volume of this journal, which appeared originally in 1908 under the title "The Illuminating Engineer," now makes its appearance.

Restrictions, notably in regard to the supply of paper, still limit expansion.

Readers will, however, observe some changes. New and more modern headings are introduced. The front page of the cover has been remodelled.

A significant innovation is the introduction of a new subtitle at the foot of that page — "The Journal of Seeing and Illumination." Both subjects should be considered together.

In the present issue there are several special notes on vision and the effect of light on the eye. We hope to devote more attention to these aspects in future.

Illumination Notes and News

I.E.S. Visits

The programme of the Illuminating Engineering Society for the present session includes a number of visits, the first of which took place in October last, when I.E.S. members and friends were received at the Laboratories of the General Electric Co., Ltd., at Wembley.

The next event of the kind is on **Tuesday, March 23,** when members will have an opportunity of visiting the Plastics Division of Imperial Chemical Industries at Black Fan-road, Welwyn Garden City. The visit, which will begin at **2.0 p.m.,** will cover the Technical Service and Development Department and the Optical Development Department.

Another forthcoming visit of great interest is that to Pinewood Studios, Iver Heath, Bucks., which has been arranged for **Tuesday, April 27.** There is much to be seen at the studios which will be of interest to members, particularly as this visit follows closely upon the papers on film studio lighting which are to be given at the sessional meeting of the Society in April. Accordingly, it has been decided that this visit will begin at **11.15 a.m.** at the studios where lunch for the visitors will be arranged.

Attendance at both of these visits is unfortunately restricted. Members are, therefore, invited to make application for places *as soon as possible* to the Secretary, the I.E.S. (32, Victoria-street, London, S.W.1.). In the case of the Pinewood Studios it is hoped, if the number of members wishing to take part greatly exceeds the limit, to be able to arrange an additional visit, on the same day but to another studio in the vicinity of London.

It is not possible to make special transport arrangements for these visits. It may be mentioned, however, that Welwyn Garden City is about 50 minutes journey from King's Cross Station and that those in London can reach Pinewood Studios by taking the Piccadilly tube to Uxbridge Underground Station and thence by bus (leaving the station at 10.40) to the studios.

It will be recalled that occasional informal meetings (to which reference is made on p. 4) and visits in the vicinity of London formed pleasant features in pre-war I.E.S. programmes and it is encouraging to note that they are now being resumed.

Next I.E.S. Meeting in London

On **February 10** a paper on **The Lighting of Architecture** will be read by Mr. G. Grenfell Baines, A.R.I.B.A., at the joint meeting of the I.E.S. and the R.I.B.A. at the School of Hygiene and Tropical Medicine (Keppel Street, London, W.1).

The paper will compare the characteristics of architecture before and after the advent of modern artificial lighting, and will also give consideration to the design of lighting conditions in harmony with architectural effect and to the proper use of lighting fittings in order to create a pleasing impression.

A Word in Season

We referred recently to the address delivered by Mr. J. M. Waldram, conveying greetings to the Illuminating Engineering Society in the United States, on the occasion of their recent National Technical Conference in New Orleans. The address was admirably delivered and most cordially received. A summary has since appeared in *Illuminating Engineering* (Nov., 1947, pp. 837-8).

In the main portion of his address Mr. Waldram reviewed the work of our Society, explaining the nature of the Centres and the objects of the Transactions which, though necessarily small in bulk, aimed at a high standard of contents. He described some of the work done by the Society in connection with war-time lighting problems, and reviewed the educational problems with which it was now called upon to deal.

His final words, surveying the future, revealed a lofty conception of the duties of the illuminating engineer. Technically there was little beyond their reach. if sufficient trouble were taken and if resources were fully exploited. Impossible things might be done in this mid-twentieth century! It was necessary, however, to know not only how to do things but what we ought to do. "Not what it would be grand to do, nor what it will pay to do, but what we *ought* to do.

"Our need to-day is not to know more about things, but more about people.... We can speak to the world, but what are we to say to the world?"

Lectures to Children

Members of the I.E.S. are reminded that the I.E.S. standard lecture to school children is to be demonstrated to members of the Society at 2 p.m. on Friday, January 30, in the Reynolds Hall of the Manchester College of Technology.

Exchange of Literature With Australian I.E.S.

We note with pleasure the cordial reception of the suggestion of an exchange of publications between the British and Australian Illuminating Engineering Societies. Arrangements are already being made for the secretaries of I.E.S. Centres and Groups in this country to receive literature from Australia, as they already do from the I.E.S. in the United States; copies of our own *Transactions* and *Light and Lighting* being sent in exchange to the various Australian societies. It will be of the greatest interest to I.E.S. members in this country to be thus kept informed of what is happening in Australia.

American I.E.S. Handbook on Illuminating Engineering

Much interest has been expressed in this handbook, of which only a few specimens have yet filtered into this country. A considerable number of I.E.S. members have requested Headquarters to obtain copies on their behalf. Unfortunately the formalities involved and the difficulties in remitting cash to America have been accentuated by a recent tightening up of regulations. It now seems evident that permission to import a number of copies and to pay for them in bulk is much more difficult to obtain than when arrangements are made individually for the purchase of single books. I.E.S. members would probably do best to apply direct to the American I.E.S. (31, Madison-avenue, New York), subsequently arranging the remitting of dollars through their own banks. If, in so doing, they mention their connection with the I.E.S. in this country we understand that some reduction on the published price ($7.50) may possibly be made.

I.E.S. Informal Meeting

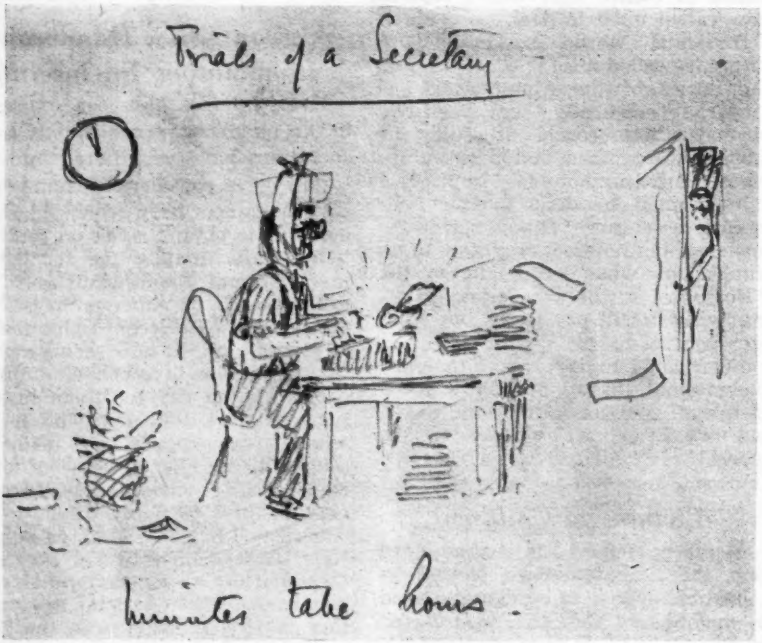
The second Informal Meeting of the I.E.S. to be held in London during the present session will take place at **6 p.m.** on **Tuesday, February 24** at the Lighting Service Bureau, 2, Savoy Hill. On this occasion the meeting will take the form of a discussion **"That good artificial lighting is an adequate substitute for natural lighting."** The proposers will be Mr. L. H. Hubble and Mr. N. Sizer. The motion will be opposed by Mr. P. V. Burnett and Mr. W. Allen, both of whom are well known for their work in connection with natural lighting.

It is understood that both the proposers and opposers will be given a definite time limit in which to state their respective cases after which the discussion will be thrown open to the meeting. It is hoped that many members will take the opportunity to participate in this informal discussion which, as is the practice with such meetings, will not be formally reported.

The chair will be taken by Mr. J. M. Waldram, senior Vice-President of the Society, who will sum up at the end of the discussion.

I.E.S. Summer Meeting

Initial notices for this event have now been circulated to members of the I.E.S. In order that the necessary arrangements for accommodation and the various social events can be made members are requested to complete the form and return it to the Secretary of the Society not later than February 20. Final notices requesting definite bookings will be circulated nearer the event.



The above amusing sketch figured on a recently circulated Christmas card. It may perhaps be revealed without indiscretion that the artist who "dashed off" this effort was Mr. J. M. Waldram.

Forthcoming I.E.S. Meetings

(Provisional List)

MEETINGS IN LONDON

1948.

Feb. 10th. Sessional Meeting. MR. G. GRENFELL BAINES on **The Lighting of Architecture** (Joint Meeting with the R.I.B.A.). (*At the School of Hygiene and Tropical Medicine, Keppel Street (Gower Street), London, W.C.*1.) **6 p.m.**

Feb. 24th. Informal Meeting. DISCUSSION: **That good artificial lighting is an adequate substitute for natural lighting.** Proposers: MR. L. H. HUBBLE and MR. N. SIZER. Opposers: MR. P. V. BURNETT and MR. W. ALLEN. (*At the Lighting Service Bureau, 2, Savoy Hill, London, W.C.*2.) **6 p.m.**

Mar. 9th. Sessional Meeting. MR. H. G. JENKINS and MR. J. N. BOWTELL on **High Voltage Fluorescent Tubes.** (*At the Lighting Service Bureau, 2, Savoy Hill, London, W.C.*2.) **6 p.m.**

Mar. 23rd. Visit to the Plastics Division of Imperial Chemical Industries, Ltd., Welwyn Garden City. **2 p.m.**

MEETINGS OF CENTRES AND GROUPS

1948.

Feb. 2nd. MR. S. W. RICHARDS on **Mine Lighting.** (*At the Leeds Corporation Electricity Dept., Whitehall Road, Leeds.*) **6 p.m.**

Feb. 2nd. MR. L. H. HUBBLE on **Lighting of Retail Stores.** (*At the Medical Library, The University, Western Bank, Sheffield.*) **6 p.m.**

Feb. 4th. MR. P. CORRY on **Light and Colour in Play Production.** (*At the Minor Durant Hall, Oxford Street, Newcastle-upon-Tyne.*) **6.15 p.m.**

Feb. 5th. MR. H. L. TREDREE on **Future Trends of Fluorescent Lighting.** (*At the Cardiff Corporation Demonstration Theatre.*) **3.30 p.m.**

Feb. 5th. MR. T. O. FREETH on **Lighting for Effect** (Joint Meeting with the Electrical Association for Women, Manchester and Salford District Branch). (*At the Reynolds Hall, College of Technology, Sackville Street, Manchester.*) **6 p.m.**

1948.

Feb. 6th. MR. T. S. JONES on **Industrial Lighting and Colour.** (*At the City of Nottingham Gas Dept., Demonstration Theatre, Parliament Street, Nottingham.*) **5.30 p.m.**

Feb. 6th. MR. E. A. FOWLER on **Practical Aspects of Interior Lighting Installations.** (*At the Electricity Showroom, Market Street, Huddersfield.*) **7 p.m.**

Feb. 10th. MR. G. A. JONES on **Lighting for Photography.** (*At the Liverpool Corporation Electricity Showrooms, Whitechapel, Liverpool.*) **6 p.m.**

Feb. 12th. MR. T. O. FREETH on **Home Lighting.** (*At the Electricity Department Demonstration Theatre, Charles Street, Leicester.*) **6.30 p.m.**

Feb. 12th. MR. J. B. S. SMYTH on **Lighting Problems in Cinema Studios.** (*At the Bradford Corporation Electricity Offices, Sunbridge Road, Bradford.*) **7.30 p.m.**

Feb. 18th. "Brains Trust." (*At the Cleveland Scientific and Technical Institution, Corporation Road, Middlesbrough.*) **6.15 p.m.**

Feb. 19th. MR. T. S. JONES on **Textile Lighting.** (*At the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow, C.*3.) **6 p.m.**

Feb. 20th. MR. W. T. SOUTER on **The Lighting of Churches.** (*At the Heriot-Watt College, Chambers Street, Edinburgh.*) **6.30 p.m.**

Feb. 27th. Annual General Meeting and Address by the President (DR. J. W. T. WALSH). (*At the Imperial Hotel, Temple Street, Birmingham.*) **6 p.m.**

Mar. 1st. MR. W. ALLEN on **Present Trends in Daylight Studies.** (*At the Medical Library, The University, Western Bank, Sheffield*, 10.) **6 p.m.**

Mar. 2nd. MR. W. ALLEN on **Present Trends in Daylight Studies.** (*At the Corporation Electricity Dept., Whitehall Road, Leeds.*) **6 p.m.**

Mar. 3rd. DR. J. H. NELSON on **Colour and Lighting in Industry.** (*At the Minor Durant Hall, Oxford Street, Newcastle-upon-Tyne.*) **6.15 p.m.**

Mar. 5th. MR. G. A. JONES on **Lighting for Photography.** (*At the City of Nottingham Gas Dept., Demonstration Theatre, Parliament Street, Nottingham.*) **5.30 p.m.**

Mar. 5th. MR. C. DYKES-BROWN on **Cold Cathode Fluorescent Lighting Installations.** (*At the Electricity Showroom, Market Street, Huddersfield.*) **7 p.m.**

(Secretaries of Centres and Groups are requested to send in particulars of any changes in programme, mentioning subject, author, place, date and time of meeting; summaries of proceedings at meetings (which should not exceed about 250–500 words) and any other local news are also welcome.)

Membership of the I.E.S.

The following statement has been prepared by special request in order that members of the Society and others may have a concrete statement of the advantages of membership of the Illuminating Engineering Society.

The question has not seldom been asked by prospective members of the Illuminating Engineering Society, "Why should I join, and what are the benefits of membership?" The answer to this question depends to a large extent on the point of view of the individual. Broadly speaking, however, the benefits may be divided into two groups, the visible and the invisible. In the first group we may reckon the privileges of attendance at meetings and participation in discussions, the receipt of the Transactions and of "Light and Lighting," by which all those interested in lighting matters are enabled to keep abreast of progress in the subject and, finally, frequent opportunities to make and keep contacts with others who are also actively interested in everything which furthers the cause of good lighting.

Many members of the Society feel, however, that the "invisible" benefits are probably much greater than those which have just been enumerated. What, then, are these invisible benefits?

Objects of the Society

The answer, in general terms, is to be found in the objects of the Society as set out in its Memorandum of Association, viz., the promotion of the general advancement of illuminating engineering and the utilisation of natural and artificial light and the dissemination of knowledge on lighting matters. Anything which tends to foster an intelligent interest in lighting matters, whether among industrialists, technicians, or the general public, adds momentum to a movement which cannot fail to have a marked influence on all who are concerned with the application of light in daily life, whether they be research workers, architects, manufacturers, consultants, or those engaged in the supply of energy for lighting. It follows, then, that the highest service of all which the Illuminating Engineering Society can perform for its members is to lose no opportunity of bringing home to everyone the importance of good lighting as an element in satisfactory living.

Society Activities

Before, during, and since the war the I.E.S. has been called upon by various Government departments to give advice on lighting problems and to appoint members on Government committees. For example, the Society has taken a very active part in the work of the Ministry of Transport committees on street lighting and road traffic signs; during the war members of the I.E.S. served on numerous committees, each of which studied particular lighting problems, many of which gave rise to original research, which has since proved beneficial in more peaceful applications; and both during the war and after the I.E.S. has been represented on the Ministry of Works Codes of Practice Committee, which includes in its programme recommendations for lighting in homes, schools, etc.

Many members of the I.E.S. will be familiar with the Stationery Office publication, "Post-War Building Studies, No. 12—The Lighting of Buildings." This book was a report of a D.S.I.R. Committee, on which the I.E.S. was largely represented, and it has done much to impress on the architect and others the important part played by lighting in building design. All lighting engineers will agree that this is a good thing and worthy of their support, and is just one instance of the way in which the I.E.S. helps to disseminate knowledge of lighting matters.

The Society is also represented on committees of the British Standards Institution whose work will need no description, whilst the importance of the work of the National Illumination Committee was described by Dr. Halbertsma in his recent address to the Society. All such work in improving the standards of illumination, standardisation of appliances, etc., must surely be of the greatest value to the lighting engineer, affecting as it does his daily work.

The I.E.S. has achieved both national and international recognition, and many

inquiries are directed to its offices from all parts of the world whilst its publications are circulated to members, subscribers and libraries in many countries. The Society is fortunate in including amongst its members some of the most prominent scientists, physicists, research workers and lighting engineers in the country to whom lighting problems can be referred, and whose expert advice is always at the disposal of the Society.

Publications

During the last few years the membership of the Society has been trebled, but owing to the existing restrictions on the use of paper the size of its publications has necessarily been reduced. The Society is therefore unable at present to extend the scope and presentation of its journals as it would wish, but there is every intention of doing so as soon as conditions permit. Reference might, however, be made to the I.E.S. Code, which contains recommended values of good lighting which are generally accepted throughout the country and have also found acceptance abroad. The last issue of the code was made in November, 1946, and already some 10,000 copies have been sold. The value of the Society's work in this connection is beyond doubt.

It is as well to emphasise at this point that the Society is a cultural one and that the opinions that it may express from time to time are given after due consideration and discussion of the views of the many interests, such as scientists, research organisations, industrial organisations, users of lighting and lighting engineers, which it represents.

Education

Reference has already been made to the increase of lighting knowledge in the architectural profession, and the Society has also taken very active steps to improve education within the lighting profession itself. As a result courses for the City and Guilds intermediate examination in illuminating engineering are now in progress in London, Cardiff, Manchester, Birmingham, Leeds, and Glasgow, and at the request of the Society a textbook on the subject has been produced. The Society has also instituted a Register of Lighting Engineers, one of the qualifications for which is the City and Guilds intermediate examination, and which is intended to give some recognition to the qualified lighting engineer and raise the status of his profession.

The above points show the benefits of membership of the Society, whether in the Corporate Membership or Sustaining Membership classes. The latter class, includes over 100 firms in the lighting industry and industrial organisations who are interested as users of lighting.

The I.E.S. keeps before the public the need for good lighting and has been instrumental in raising the standard of lighting throughout the country. Though the education of the public in general, and of that section which is vitally concerned with good lighting in particular, is part of the activities of the Society, the actual implementation of its recommendations must fall on the firms in the lighting industry and practising lighting engineers whose co-operation with the Society is in the interests of all concerned.

I.E.S. Summer Meeting

Members of the I.E.S. will already have noted with great interest that the address following the annual general meeting of the Society this year, which will form part of the programme for the summer meeting at Harrogate in June, will be given by Mr. Ward Harrison.

Mr. Ward Harrison has been active in illuminating engineering since 1909, and is now Director of Engineering for the Lamp Department of the General Electric Company at Nela Park, Cleveland, U.S.A. He has made many contributions to lighting practice, particularly in the fields of general illumination and street lighting. He is also the author of several books on illuminating engineering and of many technical papers.

All lighting engineers will be aware of the work that Mr. Harrison carried out with Mr. E. A. Anderson many years ago in connection with the coefficient of utilisation method used in illumination design calculations.

Mr. Harrison is a Past-President and Fellow of the Illuminating Engineering Society of America and a Fellow of the American Institute of Electrical Engineers. In 1940 he was awarded the Honorary Degree of Doctor of Illuminating Engineering by the Case Institute of Technology.

It is understood that Mr. Harrison's address at the summer meeting will be entitled "Some Frontiers of the Lighting Art." No doubt some mention will be made in the address of the approach to lighting problems in the United States, with possibly some views on brightness engineering.

The Application of Modern Flash Discharge Tubes

Summary of a paper read by Mr. C. R. Bicknell at the meeting of the Illuminating Engineering Society held in London on January 13, 1948

During the recent war a demand arose for a means of producing single flashes of light of extremely high intensity for night aerial photography leading to the development of the flash discharge tube. Generally speaking a flash tube consists of a tube of hard-glass or quartz, into the ends of which electrodes are sealed, the tube itself being filled with a rare gas at low pressure. The flash is produced by a discharge through the tube from a condenser and may be produced at relatively long intervals or in rapid succession. The duration of the actual flash varies with different types of tubes and may be from 1 to 1,500 micro-seconds.

One of the effects of the very high current density in a flash tube is to produce light with very good colour rendering properties. Xenon gas is now used in all the tubes of the type described by the author, the spectrum of a xenon-filled tube comparing very favourably with that of sunlight.

A very important point in connection with light sources used for photography is the accuracy of reproduction of the light output. With the tubes described it was stated that provided the voltage and capacitance remain constant the light output per flash will also be constant.

Control of Triggering

Control of the triggering, or striking, impulse can be effected by switch, microphone or light sensitive cell. The former is the most common, the switch being operated by hand, by the release mechanism of a camera shutter or by other means. When synchronising the flash with a camera shutter it must be remembered that in a well-designed flash tube circuit the time lag between the initiation of the discharge and the attainment of peak light output is only about 50 micro-seconds, and the flash becomes photographically effective earlier still. This means that the flash is faster than the shutter, which must be opened before the trigger switch is closed.

Microphone triggering is used when a noise is associated with the operation at the time the picture is required. In such cases it is usual to darken the room and open the camera shutter before the operation is set in motion.

Photo-cell flash operation may be usefully employed when it is desired to use a number of tubes for a single photograph.

Loading of Tubes

The author gave some details regarding the maximum loading of the tubes which he had described, the approximate efficiency of which was about 40 lumens/watt. Overloading of a tube on single flashes will cause crazing of the tube owing to the over-violence of the discharge, after which cracks may appear in the walls of the tube when they have cooled down.

Those using flash tube equipment must appreciate that such equipment can be a source of danger unless proper precautions are taken in its design and construction. It was stated that one of the tubes described when operating under the maximum loading of 200 mfd. and 2,000 volts passed an average current throughout the full discharge period of approximately 400 amps., the peak value being several times greater.

Photography

Photography represents one of the most important fields of application of flash tubes. Tubes are available with a speed of flash capable of photographically arresting the motion of such fast-moving objects as projectiles in flight. They can, therefore, be used to make permanent records of phases of movement.

Effective use has been made of flashes synchronised with the shutter of a ciné camera to obtain pin-point photographic analysis of motions, and it is not beyond the bounds of possibility that flash tubes may one day become the normal light sources for film projection.

The essential requirements of colour photography are colour quality of the illuminant and very high intensity lighting, several times the amount that is adequate for ordinary "black and white" work being necessary. The spectral quality of flash tube emission is excellently suited to this purpose, whilst the intensity is only limited by the number of tubes available with equipment for their operation, it being an important factor that the necessary high value of illumination can be obtained without exposing the subject to excessive heat.

I.E.S. Centre Activities

Birmingham Centre

The joint meeting of the Birmingham Centre and the Midland Section of the Institute of Production Engineers which was held on December 5 took the form of a discussion on "Lighting and Industrial Decoration."

Mr. S. D. Lay, speaking as an industrial lighting engineer, stressed the need for planning the decoration of factories, pointing out that bright colours were stimulating for a time but soon became rather tiring. As a method of indicating the various service pipes, conduits, etc., which are found in factories, he suggested marking them with appropriate bands or arrows which would also indicate the direction of flow.

Mr. A. S. Hall, an architect, touched on the psychological aspect, and suggested that yellow light tended to make people hurry whilst blue light tended to slow them down.

A lively debate followed the principal speakers and was concluded by Dr. Nelson for the I.E.S. and by Mr. S. B. White for the I.P.E.

Glasgow Centre

Members of the Glasgow Centre at their meeting on November 27 heard a discussion on "The Place of Science in the Art of Lighting," which was opened by Mr. Alister MacDonald. He stressed that science should be the hand-maiden, not the dictator, of the architect, and that not only efficiency but human emotion had also to be considered in the design of lighting schemes. Mr. R. O. Ackerley, whilst generally agreeing with these opinions, urged closer co-operation between the architect and lighting engineer, and suggested that the latter should be consulted whilst the design of a building was at the drawing-board stage in order that the lighting could form an integral part of the design.

At a subsequent meeting held on December 18 Mr. F. Widnall delivered a paper entitled "The Development of Fluorescent Lighting in Mines." Details were given of the construction of the most recent fittings being used in experimental installations in mines, and figures were given of tests carried out on glass and "Perspex" tubes for protection of the lamp.

Manchester Centre

At a meeting of the Manchester Centre, held on December 4, Mr. W. Imrie-Smith lectured on "Industrial Lighting." In opening, he referred to the number of codes and recommendations from which it appeared that good lighting was merely a matter of applying certain rules, whereas, he explained, an analytical approach was necessary in each individual case. He stressed the need of avoiding glare from large area light sources of comparatively low brightness, such as fluorescent tubes.

Mr. Imrie-Smith then gave the results of tests which showed that accuracy of work is improved by light surrounds. The painting of machinery, he said, could be a great help in this connection, but he thought that the lighting engineer should not be concerned with the colour but only with the resulting brightness.

In approaching any lighting problem it was suggested that the lighting engineer should ascertain exactly what it is that the operative has to see. In some cases this might be a very difficult thing to establish, but, until it is, however good the general illumination may be, the lighting problem cannot be properly solved.

Examples were given and illustrated, showing how inspection problems had been overcome and how light had been used to accentuate the details which had to be seen by operatives. It was pointed out that it was not always necessary to see objects as they really are, and that it was often advisable to accentuate imperfections.

The author's approach to this very wide subject was greatly appreciated and a number of interesting points were raised during the ensuing discussion.

Sheffield Centre

Recent meetings of the Sheffield Centre included a paper on cold cathode lighting by Mr. S. Anderson, which was enhanced by a number of effective demonstrations.

On December 1 a joint meeting was held with the Sheffield Section of the Electrical Association for Women, when Mr. T. O. Freeth gave a talk on "Lighting in the Home." The talk was greatly appreciated by members of both the I.E.S. and the E.A.W., to whom various suggestions were made for the improvement of lighting in their own homes.

Some Current Experiments On Vision

At a recent meeting of the Optical Group of the Physical Society, held on November 26 at the Northampton Polytechnic, members of that Group and of the Colour Group listened to three papers of great interest to workers in the field of physiological optics. In the first paper, on "Quantum Fluctuations and Visual Acuity at Low Brightnesses," Dr. M. H. Pirenne described work he had carried out to determine the ability of the eye to detect a large black disc on a uniform background only a little brighter than the threshold when this was presented to the eye for a very brief interval of time such as 0.03 sec. His object was to find an explanation for the rise of visual acuity with brightness. Hecht had supposed that the rods in the retina had different thresholds of excitation, so that as the brightness was increased more and more rods came into action. The quantum conception of vision, said Dr. Pirenne, made this complication of structure unnecessary because increase of brightness increased the number of retinal receptors which received the energy necessary for excitation. He assumed that in order to detect the presence of the black disc it was necessary that it should obliterate at least one receptor which would otherwise be illuminated. The receptor was probably not a single rod but a group of interconnected rods, since it had been found that the number of rods and cones in the retina was at least a hundred times as great as the number of fibres in the optic nerve. Dr. Pirenne concluded his lecture by describing a number of alternative theories which had been proposed but which failed to explain the observed facts.

The second paper was read by Mr. D. J. Day, who described some "Experiments on Flash Visual Acuity," which he had carried out at the Imperial College. He had studied the effect on acuity, as judged by the Landolt broken circle test, of the duration of a flash giving various levels of illumination and showed the results in the form of a series of curves upon which it was hoped to base a theory of the response of the eye to very brief stimuli.

This paper was followed by a description, given by Dr. Mary Lord, of work carried out in Dr. Wright's laboratory on the involuntary eye movements which take place during fixation. The subject in these experiments was always prone and was required to fixate a point source of light. His eyeball was illuminated by a bright beam of light, so directed that its image fell on the blind spot and therefore did not upset the observer's vision in any way. The reflection of this spot of light from the front of the eyeball was used to study the small involuntary movements which took place, and a combination of photocells and recording apparatus was arranged to give a continuous record of these movements. Miss Lord said that so far it appeared that the excursions of the eyeball were considerably larger than had been expected, but the work was still in progress and it was too early to give any very definite quantitative results.

L.M.S. Research

A well-produced illustrated leaflet describes the Scientific Research Department of the London, Midland and Scottish Railway, which is conducted on quite an impressive scale. There are separate sections entitled engineering, metallurgical, paint, physics, and chemical, and, in an appendix, a list of papers published by members of the department is given.

The Physics Section includes a specially equipped photometric darkroom. Here, colour measurements are made with a Donaldson tri-chromatic colorimeter, by the aid of which signal glasses and coloured surfaces can be studied. The other permanent equipment covers general work on lamps and fittings. Portable instruments are available for taking outside measurements of illumination, of which the A.R.P. photometer, useful for making measurements at very low illuminations, is a special instance.

No doubt similar records have been published by other railways. It would be interesting to get particulars — especially in regard to facilities for testing and research in the lighting field.

Lighting of Large Retail Stores

By A. W. JERVIS

The following is the first of a series of three articles dealing with the past, present and future problems associated with the lighting of large retail stores.

The problem of lighting large retail premises is fundamentally different from any other type of lighting installation, and in the past too little consideration has been given to the individual characteristics associated with each particular store. There have been too many installations chosen on foot-candle intensity without regard to the problem of glare and vision.

This has, to a large extent, been the fault of the materials available, and it can be safely said that large retail stores have always been to the forefront in using new light sources and fittings. From the days of the carbon lamp up to the beginning of the last war propaganda from the lighting industry and electric supply authorities has found ready acceptance amongst the retail trade.

This eagerness to lead in matters pertaining to efficient merchandising has not always been to the advantage of the stores, and the normal lag between the commercial introduction of a new light source and the development of correct lighting fittings has often meant the employment of lamps in fittings entirely unsuitable for their purpose and surroundings. Then, when they have caught up with lamp developments, the fittings manufacturers have had to pay too much attention to foot-candle requirements and too little to developing new techniques in illuminating engineering. The science of lighting as it was applied in the early gas installations is still in use for an offspring which has rapidly outgrown its parent, and it is time that "Lighting" should be divorced from its parent "Light" and made to stand on its own feet.

The efficiency of an installation depends on its ability to fulfil all the functions required, and the functions required are totally different in retail showrooms from that of industrial premises or even offices. The realisation of this has determined the present trend in store lighting design. No hard and fast rules can be applied to cover all classes of stores. High, medium, or popular grade, each need different treatment, and even in the same building the factors applicable to the lighting of, say, a hardware department cannot be applied to a fashion showroom or restaurant.

Prior to the war one of the greatest enemies of good lighting was the indiscriminate use of the popular-sized foot-candle meter, and we can thank this instrument for the great number of installations which can be classified as causing glare. Future education in illuminating engineering should stress that the use of this instrument is to check results which should not alone decide whether one installation is better than another. It is only part of the story and its readings should be treated in their proper perspective.

The main functions (for want of a better word) required from a store lighting scheme are to provide an atmosphere conducive to good merchandising and to enable customers and staff to see perfectly not only the immediate objective but also distant objects, without eyestrain over long periods of time. One of the biggest differences between lighting a store, as compared with an ordinary shop, is the long vista; visible light sources, which in a small area are above the line of vision, tend to come lower as the distance increases and, although the relative brightness of an object is smaller, this is offset by the surroundings becoming darker, so that the results in a long showroom are a series of bright spots, restricting the visibility and causing discomfort to occupants.

The use of built-in lighting, semi and totally indirect fittings—were methods adopted to overcome this problem, but they all suffered to a great extent from the disadvantage that the operating expense was higher than an installation using suspended enclosing units for the same foot-candles. For this reason, no serious attempt had been made to make a correct scientific approach to the problem.

The stores in this country were not alone in their troubles, and whilst the

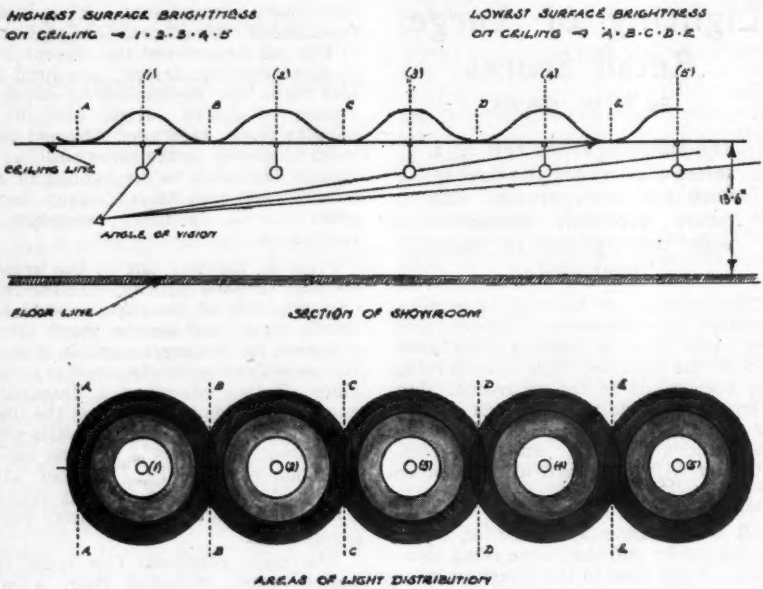


Fig. 1. Showing different background contrasts varying with angles of vision, suspension of fittings and the spacing of fittings.

large American store did not watch the cost to the same degree, they were increasing their lighting intensities, in an effort to outshine their competitors. It was a case of the "brightest" shop being the most attractive, and all sales publicity from fittings manufacturers stressed this point. This was the position up to the marketing of the fluorescent lamp, which brought matters rapidly to a crisis and provided many a headache for the lamp manufacturer, who could foresee his new development killed by kindness. An immediate rush to install these new lamps in place of existing tungsten lamps, in an effort either to get the same light for half the cost, or alternatively to double the lighting intensity, brought its own reward, and large numbers of people are still reluctant to install these lamps because of early mistakes.

The war-time embargo on their use in commercial premises was a blessing in disguise as it gave the fittings manufacturers a chance to catch up with this problem before it got too far out of hand. Full advantage of this delay was not taken, however, and, owing in some degree to shortage of materials, many installations using unscreened tubes are still being put in, and everybody seems to be waiting to see what other users are going to do.

Another reason given for a poor installation was that fluorescent lighting was only in its infancy, and therefore it was not worth spending a lot of money until the design of fittings became standardised, and thus cheaper. You don't wait till a baby is five years old before trying to bring him up the right way, so why should manufacturers encourage the use of bad lighting just to get orders? The answer must be left to them, but it is apparent that a wonderful opportunity to further the aims of correct lighting has not been handled satisfactorily.

Requirements of Store Lighting

The requirements of each store must depend on the class of business—and the locality—and also on the particular merchandise on sale, but it must be such that it performs its work without being noticeable. Mr. Ward Harrison and his

staff at Nela Park have classified store requirements as:—

(a) Atmosphere,
(b) Attraction,
(c) Appraisal,

or, as they call them, the three "A's" of lighting. This is the nearest we have come to a formula on paper and is a tremendous step in the right direction. Let us consider these three headings and see how they apply to our needs.

Atmosphere

The dignity of an interior can be raised or lowered by suitable lighting, and whilst the effect should create a cheerful atmosphere, it will need entirely different treatment for each grade of store, and this feature will provide the greatest variable of store lighting. To put a high-class atmosphere in a popular price store would make the customer expect that the merchandise was dear and create a sales resistance. The reverse would also be true of making a high-class store too garish. It is essential therefore that the correct atmosphere is created to suit individual requirements. This atmospheric effect can be a wonderful advantage when used correctly. For example, when a store wishes to have a speciality department selling higher-grade merchandise, suitable alterations to the lighting can effect this without large structural alterations.

Attraction

This ("A") is almost self explanatory. It must attract the customers, whether they are outside or inside the premises. It should focus attention to special features, which may be special merchandise or even a remote corner, off the usual traffic paths, and it must provide this attraction without discomfort.

Appraisal

This covers the requirements of the intensity of lighting, and will vary with the locality and time of the year. By locality is meant whether the store is in a large or small town and what the relative brightness of surrounding premises is. Variation in the time of the year, in relation to intensity of lighting, is of particular importance where the ground floor interior has no natural light, and the relative contrast between sunlight and the interior on first entering a store can make the whole interior appear very dull and dismal, unless

Fig. 2. A lighting engineer's 'nightmare.'

Fig. 3. Combination fittings using fluorescent and tungsten lamps, giving emphasis to the merchandise.

suitable means are taken to offset this near the entrances.

This factor will become of greater importance if the present tendency to do away with arcade windows in front of the store is developed.

These three requirements form a solid basis on which store lighting can be planned, and with the advent of the fluorescent lamp, suitable tools are available for the job.

Use of Fluorescent Lamps

A lot has been written about the relative merits, or otherwise, of these lamps, and examples of eyestrain, loss of efficiency, etc., have been quoted as proving that they are no good. I do not wish to enter into an argument on this subject, and can only quote from my own experience. Where I have heard adverse complaints from people working under them, I have **always** found that it was *the lighting* that was wrong, and had nothing to do with the lamp.

When anything new comes on the market, it is always worth while studying its particular characteristics and making allowances for any special characteristics. As an example, the high initial brightness, dropping after the first 100 hours, is a nuisance, and I would like to see the lamps aged before sale, but I appreciate the tremendous job this would be, and hope that future development will obviate this fault.

Owing to the colour of the light furnished, much greater attention must be paid to colours of walls and ceiling, and there is still a great deal of investigation to be done in this field. I will deal with this aspect in more detail later, but in passing I would mention that the intensity of the installation has a great deal to do with complaints of colour distortion. I hope that in the future an intermediate colour tube, about 4,500 deg., will become universally available; such a tube would be of tremendous value to stores.

There is no doubt that fluorescent lamps have been a tremendous help in offsetting the present load restrictions and using the maximum permitted under the S.R. and O. No. 1942/1930 of 1½ watts per square foot. A really good job can

be done, and in practice the average figure now being used is about 1 watt.

It is important at this stage, I think, to say a few words about the economic aspect, and it should be made clear that the installation of these lamps will not necessarily mean lower costs; in fact, if electricity costs under 1½d. per unit, it means increased expenses, because the saving on consumption will not be sufficient to offset the increased lamp costs. At the moment very few stores have a resultant average price of less than 1½d., and before making any statement as to costs, the type of tariff should be investigated. For instance, premises where the fixed charge of a two-part tariff is based on rateable value, will have to be judged on the unit charge only, and as this is usually ½d. per unit (plus coal clause) on about .95 pence, the overall costs of a fluorescent installation will tend to be higher than a tungsten scheme. Provided that no false claims are made and the position made quite clear, this should not be a deterrent to their use.

One of the greatest disadvantages of fluorescent lamps in a commercial installation is the difficulty in providing an adequate "punch" of light down on to the merchandise. Increasing the number of tubes does nothing to help, and we are left with all the light on the ceiling and nothing down below. This is specially noticeable where there are bare tubes or diffusing fittings. The degree to which this feature is offset will depend on the atmosphere required.

Reflector Spot Lamps

A newcomer to the range of lamps in this country is the reflector spot (or flood) lamp of 150-watt size, with the interior of the specially shaped bulb mirrored on the inside of the glass, resulting in a concentrated output of light and a very high maintenance factor, compared with the use of an ordinary lamp in a mirrored floodlight. Because of its concentrated light beam, the heat directed is considerable and it cannot be used near to plastics, such as "Perspex," etc.

With these two, fluorescent lamps and reflector floods, we have the tools with which the new era of internal lighting is being created. Experience to date shows that when restrictions of building operations and fuel economy are lifted, then the illuminating engineer will have a greater influence on internal design than ever before.

Fig. 4. Modern plastic-shielded fittings in a fashion showroom.

Light and Vision: The Wisdom of The Ages

Throughout the Ages, light, which is now the professional preoccupation of the illuminating engineer, has been the subject of speculation by philosophers and men of science. We propose, in this and subsequent issues, to give extracts from such treatises and addresses. The first of the series, which follows, is taken from "The Senses and The Intellect," by Alexander Bain, A.M. (1855).

I.—The Pleasures of Light

"I shall commence with the sensation of mere light, and shall take the diffused solar radiance as the leading example. This is one of the most powerful of the simple influences that affect the human sense. Light is eminently a source of pleasure, which rises in degree, within certain limits, in proportion to the abundance of the luminous emanation. In clear, strong sunshine, filling the entire breadth of the eye and freshly encountered, there is a massive powerful influence of pleasurable elation, acutely felt. The effect is sufficiently intense, massive, and keen to make a predominating or engrossing emotion, like alimentation, warmth, or the other powerful forms of organic and muscular feeling formerly described. The quality that most distinguishes it from these other feelings is the endurableness of it. The physical influence of light, although able to excite a first-class sensation in point of power, is yet so gentle that we can endure it far longer than we can any other sensuous influence of similar efficacy. This is one of the peculiarities of pleasure or emotion that we understand by the term 'refinement'; the pleasures of the eye are said to be the most refined of the enjoyments of sense.

"The influence of the solar ray is evidently favourable to the animal functions—the respiration or digestion, etc., probably through both physical and mental causes; at any rate the feeling engendered is freshening and cheering, and can often suffice to support the frame of mind against the depressing organic influences.

"The impress of vivid illumination remains in the mind when the original is gone, and becomes an object of recollection, anticipation, and longing, more than any other pleasure of sense, excepting always the strong appetites at their periods of pressing urgency.

"It will be necessary next to advert to the different forms and varieties of the sensation of light. Notwithstanding the endurability of the eye, the sunlight may be too strong, and too long continued; there arises, then, a painful form of fatigue in the eye and in the head. But as the light that reaches us is nearly all reflected light from the surfaces about us, the sky, the landscape, the walls of buildings, etc., there are many varieties of it, and many different effects on the internal sensibility. There is this peculiarity, however, in a time of sunshine, that a large portion of the sun's unaltered rays reach the eye by reflection, so that we have predominating the sensation proper to pure sunlight. Next in character to the original ray and its mirrored reflection is the radiance of strong white surfaces, as the clouds, the sea foam, white walls, chalk cliffs, white dresses, etc. This gives us very much of the sensation of light, but in a less intense form; indeed, the richness of these surfaces consists in reflecting abundantly the solar ray when abundantly receiving it.

"The course of the day and of the year gives us all degrees of illumination, from outer darkness to the radiance of midsummer noon. Of darkness, or the total absence of light, as a habitual thing, I could only speak by contrasts, or opposites to the language above used. As the repose from light it is not only endurable but welcome; with shade and shadow we have no necessarily unpleasant associations. The mixing up of the proper amount of dark with the daily sun shower is one of our arts for adjusting and regulating our pleasures. The grateful emotion of light is perfect only when we stop short, having attained the exact amount that the eye can bear: and for this adjustment the command of darkness is necessary.

"Before taking up the sensations of colour, it is worth while to remark on the artificial lights; their ray being different in character from the solar. A fire, or a lamp, is so much weaker than the sun's face, that we can gaze upon them directly for hours together. We have, then, what I might term a pungent

luminous sensation, more intense, concentrated, and coarse, than the diffused radiance of daylight. When the eyes are feeble, this is an unsafe luxury. There is an apparently involuntary attraction of the eye towards the flame of a candle; the real fact is, that we voluntarily turn to it to drink in a strong sensation. I call these effects coarse and pungent, because of the inferiority of the terrestrial lights to the solar ray, in delicacy and in balanced mixture, as well as of the obvious difference of sensation. Nevertheless, our experience of a brilliantly lighted room, exemplifies strikingly the pleasurable and exciting influence of a copious illumination."

British News for U.S.A.

It is pleasant to observe in the issue of *Illuminating Engineering* last received (November, 1947) reference to several developments of the I.E.S. in this country, such as the talent questionnaire which appeared in the June (1947) number of the *Transactions* and the proposed Register of Lighting Engineers. A brief summary is also given of Mr. Waldram's address of greeting to the American I.E.S., delivered at the recent Convention, to which reference is made elsewhere in this issue (p. 3).

Price Reduction of Fluorescent Lamps

The Electric Lamp Manufacturers Association have recently announced further reductions in the price of fluorescent lamps by their members.

The 5-ft. lamp which has been successively reduced in price from 36s. 6d. in 1940 to 30s. in 1943 and then to 24s. in 1945 is now reduced to 20s. The 4-ft. lamp, which first came on to the market in November 1945 at the price of 17s. 6d., is now priced at 16s. 6d.

During its normal life the fluorescent lamp gives some ten times more lumen hours than the corresponding size of tungsten filament lamp and now, with these latest price reductions, the 5-ft lamp will provide a further 15 per cent. better value for money.

The progress of fluorescent lighting, which is of particular importance to-day in view of its contribution to the nation's fuel economy, is a fine tribute to the research work carried out by the lamp manufacturers in this country.

Ultramarine

At the last meeting of the Colour Group, held on December 3 at the Geological Museum, a very interesting lecture was given by Mr. J. Pryce-Jones, of Messrs. Reckitt and Colman, Ltd. He took as his subject the material which gives its colour to one of the very few naturally occurring blue minerals, lapis lazuli. In the ancient world this was valued as a semi-precious stone, and from Byzantine times until the discovery of the process for making synthetic ultramarine, it was the chief blue pigment employed by painters, who prized it for its permanence as well as its beautiful colour.

The study of ultramarine, said the lecturer, presented the chemist with many fascinating and complicated problems. The composition of the material was not unique; it consisted of a compound of sodium aluminium silicate with sodium sulphide, but the number of sodium, aluminium and sulphur atoms in the molecule was not invariable. Variations of composition could be brought about by varying the proportions in the mixture of china clay, soda, silica, pitch, and sulphur, used to prepare a synthetic ultramarine. These variations produced a variety of shades, and more pronounced variations could be obtained by substituting other atoms, such as silver, for the sodium.

X-ray analysis gave the same structure for violet, green, and blue ultramarines, and the origin of the colour was still unknown. Ultramarine was bleached by acids and alum, although it was possible to produce a variety that would withstand the action of alum for some time. If mixed with cement it rapidly lost its colour. A variety of shades, determined purely by particle size, could be prepared from the same parent ultramarine. Some correlation could be found between the particle size, or surface area, of the individual particles in the various grades and their staining powers, reflectances and colour coefficients but, in reply to a question, Mr. Pryce-Jones said that there was no correlation between colour and hardness. He gave it as his opinion that any given sample of ultramarine consisted of a mixture of a variety of ultramarines differing slightly in structure and chemical composition.

Light and Vision

Most readers of this journal are concerned with *light* and many primarily with *lighting*, but how many reflect on the other part of the chain of operations determining perception—the process of *vision* which alone enables the operator to make use of the light provided for him?

This aspect has been forced to the front recently by the recognition that older workers, with relatively poor sight, usually need higher illumination than those whose sight is perfect, and in certain industries (printing, garment making, etc.) the percentage of employees with poor vision may well be 50 per cent. or even higher. So important did this matter of eyesight become during the war, that the Royal Ordinance Factories arranged for the eyesight of all workers to be tested and proper glasses provided where necessary —over 70,000 such examinations being conducted in the course of the war.

Those in middle age or later life very frequently call for exceptionally high illuminations for reading and similar tasks and in general get some benefit, though the extent of the possible improvement has been only imperfectly studied as yet. It should, however, be clearly understood that increasing the illumination is of little avail compared with the improvement of vision by proper optical means. This applies especially to severe close work for which even persons having normal vision may require optical aid. Thus in *Vision*, the journal of the Association of Optical Practitioners, the case of workers engaged in an operation involving the soldering of platinum filaments of minute diameter on to two copper posts, the parts held at only six inches from the eyes in order to get correct apposition, was recently cited. All the workers complained of ocular fatigue. Experiments with lighting brought little relief and it was only after the adoption of specially designed prismatic glasses, facilitating focus at the proper working distance, that the tendency to eyestrain was removed. Moreover, the rejects, formerly as high as 12½ per cent., fell to 2 per cent. and the output increased from 500 to 700 a day.

Most of the consequences of inadequate lighting, fatigue, mistakes, poor output, etc., may also arise through imperfect vision eyesight, and in *Vision* instances of serious errors and losses, arising through inability to see clearly on the part of the older operators (some of whom would not own to this defect and would not wear glasses) are mentioned.

Much concern has been expressed at the continually increasing number of roadway accidents. It has been repeatedly urged that inadequate lighting of highways (even now restricted to 50 per cent. of pre-war values) is a major cause of fatalities by night. Here again, however, the eyesight of the driver is surely quite as important as the illumination he receives. Engine drivers on railways are called upon to pass stringent tests of eyesight. Apparently, however ordinary drivers of motor cars, for whom quick and accurate vision is surely just as important, have no obligation to pass tests (as is a condition of granting driving licences in most of the United States), the only condition at present being that an applicant for a driving licence must sign a declaration that he can read a number plate of a car at 25 yards distance (if not wearing his spectacles he may not be able even to see the car!)

A further very important question, affecting service in the Forces and many occupations, is the nature of the test to be imposed. Tests conducted with a standard letter-chart at high illuminations may afford no indication of the power to distinguish gradations in light and shade in which certain people with otherwise normal vision may be de-

ficient. Variations in this respect may be accentuated when observation at very weak illuminations is involved. Capacity for "night vision" was the subject of various special tests applied during the war in connection with the Forces, and especially members of the R.A.F. called upon to fly constantly under night conditions.

Furthermore, it is worth consideration that about 8 per cent. of males are more or less colour-blind and may well have difficulty in distinguishing traffic signals with certainty. Tests of ability to recognise and distinguish colours are therefore of considerable importance, and it may be recalled that these formed the subject of a detailed report issued by the Colour Group some months ago.*

Finally, there are other faculties besides accuracy of vision—such as speed of recognition of objects on the road and quickness of response to messages conveyed through the eyes. Here, too, great differences between individuals may well exist, and there do not seem to be any recognised tests in general use. Just as the lighting engineer needs to be aware of visual power and its limitations, so the expert on vision needs to realise how greatly perception may be aided by the skilful use of light or handicapped by its misuse. Here we have to consider not only such familiar items as the effect of glare or of variation in brightness. Lighting experts have become aware how vital conditions of contrast may be. There is also much to be done in connection with colour, not merely the choice of illuminants with a view to securing natural appearance of coloured objects or certainty in matching colours, but also, on occasion, the use of some distinctive colour of light to reveal defects or details not readily perceived under normal conditions.

* Defective Colour Vision in Industry. (See *Light and Lighting*, January, 1947, p. 6.)

Manchester Federation of Scientific Societies

An interesting development in Manchester is the Federation of Scientific Societies, organised on a very simple basis for mutual help. The Calendar of Meetings for 1947-8 includes a list of participating societies, of which the local I.E.S. Centre is a member, the address of the secretary being given in each instance and particulars of all forthcoming meetings arranged in chronological order. A somewhat similar scheme, one gathers, is in operation in Nottingham and in some other cities in which I.E.S. centres participate. Nothing of the kind seems to exist in London, and although, perhaps, the number of bodies is too great to render possible a full and comprehensive list of meetings, it does seem that something similar might be arranged by confining the list (or lists) to those with similar interests.

Measurement of Photographic Transmission Density

This British Standard, approved by the Photographic Industry Standards Committee, has been prepared in close co-operation with the committees of the American Standards Association concerned and utilises a standard method of measuring "British standard diffuse vided by that body.

The British Specification discusses in detail various conceptions of density and describes three alternative methods of measuring "British standard diffuse density" by the aid of (i) the integrating sphere, (ii) opal glass, and (iii) contact printing. Copies of this specification (B.S. 1,384: 1947; 4s. net, post free) may be obtained on application to the British Standards Association (28, Victoria Street, Westminster, S.W.1), who point out the desirability of this standard being adopted in this country wherever possible.

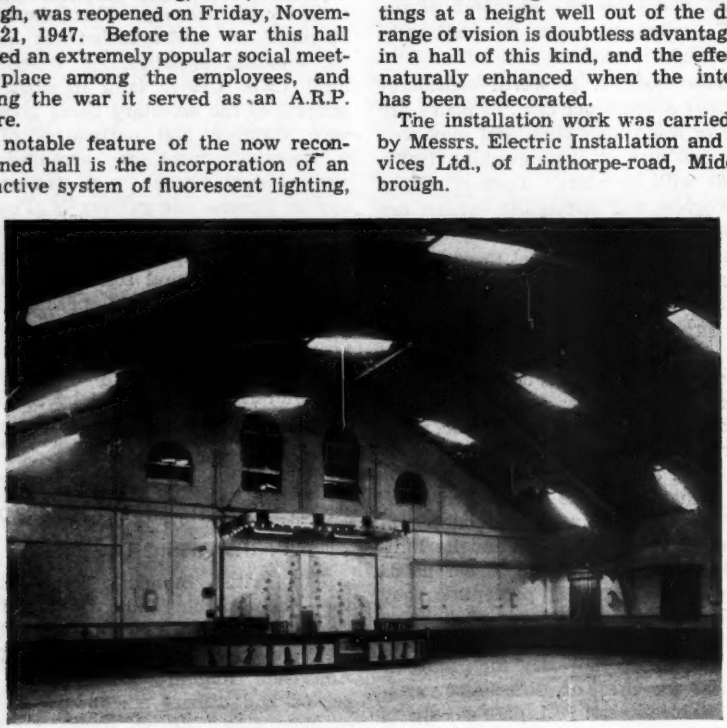
Fluorescent Lighting in a Dance Hall

The Athletic Club Dance Hall, at the well-known engineering works of Messrs. Dorman Long, Ltd., Middlesbrough, was reopened on Friday, November 21, 1947. Before the war this hall proved an extremely popular social meeting place among the employees, and during the war it served as an A.R.P. centre.

A notable feature of the now reconditioned hall is the incorporation of an attractive system of fluorescent lighting, the equipment for which was supplied by the British Thomson-Houston Company, Ltd. Mazdalux Ceiling Fittings, each accommodating two 80-watt fluorescent lamps, mounted on arched roof supports, and concealed 40-watt lamps mounted on trellises, provide soft, warm illumination throughout the hall. The stage is brilliantly lighted with fluorescent lamps concealed under the canopy. An average intensity of 10 lumens per sq. ft. is obtained, but on the stage it is approximately 20 lumens per sq. ft. The adjacent picture the appearance of the hall with the new lighting.

The mounting of the fluorescent fittings at a height well out of the direct range of vision is doubtless advantageous in a hall of this kind, and the effect is naturally enhanced when the interior has been redecorated.

The installation work was carried out by Messrs. Electric Installation and Services Ltd., of Linthorpe-road, Middlesbrough.



A view of the new lighting in Dorman Long's dance hall, reconditioned after war-time service.

Philips Blackburn Works

A visit to these works was recently paid by branch managers of Philips Electrical Ltd., accompanied by Mr. A. L. Sutherland and Mr. R. P. Sayers. Mr. C. de Witt, in welcoming his guests, explained the organisation of the factory, which employs 3,400 people, and the party visited in turn the various sections concerned with filament production, electrodes, radio valves, and fluorescent lamps and their accessories.

Fluorescent Lighting In Kingsway

Several street lighting installations using fluorescent lamps have been completed during the last eighteen months. Holborn Borough Council have long been interested in this form of lighting, and have asked the B.T.H. Co., Ltd., and the G.E.C. to undertake a demonstration installation in Kingsway, which is one of the principal thoroughfares in central London and is a double carriageway road 60 ft. wide.

Each company has installed six lanterns—two on each side of the road and two in the centre, at spacings of approximately 82 ft. and 100 ft. and at a mounting height of 25 ft. They are mounted on concrete standards manufactured by Concrete Utilities, Ltd., especially for fluorescent lighting.

The G.E.C. installation which embraces that part of Kingsway in which the company's head office, Magnet House, stands provides an intensity of 6,800 lumens per 100 ft. of each carriageway, or a total of 13,600 per 100 ft. of the complete road. Each lantern is of non-ferrous construction and houses four 5-ft. 80 watt Osram "Daylight" lamps —two on each side—of which the bottom two can be switched off for half night lighting. A twin lamp circuit is employed to give unity power factor for full or half night lighting. The centre standards carry only a single four-lamp lantern, of which one-half projects over each carriageway.

The installation in the northern sector of the road has been planned by the British Thomson-Houston Company, Ltd.

Mazdalux fluorescent street lighting lanterns, mounted at a height of 25 ft. are spaced, two at either side of the roadway and two along the centre, at intervals of approximately 82 ft. These lanterns are designed for use with three Mazda 80-watt 5-ft. fluorescent lamps, a separate reflector being employed for each lamp, and are so arranged that the bottom lamp can be used alone for late night economy lighting. The two lanterns sited along the centre of the roadway are fitted with special brackets

by which they are fixed to the attractive circular heads in which the columns terminate. Each lantern is of silicon-aluminium alloy construction, with a translucent plastic cover which protects lamps and reflectors from dust and the weather. Auxiliary gear is accommodated within the lantern and hinged end covers allow of simple lamp changing and starter switch maintenance, without disturbing the "Perspex" cover.

The Mazdalux lantern gives a luminous output of 6,380 lumens, average over lamp life; which, at the spacing used, provides 5,840 lumens per 100 ft. linear in each half carriageway; by the incorporation of the special B.T.H. anti-glare shields, however, 97 per cent. or 5,660 lumens are usefully employed by being directed into the lower hemisphere. The figure for the full width of road would, of course, be 11,320 lumens per 100 ft. linear.

The EDITOR Replies

I have received some inquiries in regard to the **Handbook on Illuminating Engineering,** recently issued by the American I.E.S. Only a few copies have so far been received in this country, chiefly by those who, being members of the American I.E.S. as well as our own, were entitled to receive copies in advance of the ordinary circulation and at special terms. I have presented my own copy thus received to the I.E.S. library and I understand that the American I.E.S. is generously proposing to donate two additional free copies.

A **review of the handbook** now appears on page 24, from which readers will gather that it is a very comprehensive treatise. The I.E.S. has been trying to make special arrangements to get copies for those of its members—a considerable number—who are anxious to receive them, and our friends in America are sympathetic. We understand, however, that the difficulty experienced in getting a licence to import a number of copies (not to speak of the uncertainty whether dollars will be available even if the licence is granted!) is very considerable.

As in so many other cases, legislation seems to be based entirely on commercial procedure and bears no relation to the special circumstances of the case. (It is obviously futile, for example, to make permission to import contingent on the volume of "trade" with the same importer in the year preceding the war!) When, however, only a single copy is desired the procedure, though still vexatious, is less involved and much more likely to yield quick results. Therefore, whilst the I.E.S. is doing all it can in this connection, I am inclined to advise members wanting copies to make their own arrangements, as suggested on page 3.

Suggestions still reach me occasionally that more should be published on **activities of I.E.S. Centres.** We do our best to give publicity to the material available. But, speaking generally, the flow of information is decidedly intermittent. It seems very desirable for Centres to appoint a "Press officer" or the equivalent to deal with this matter (as some already do). Secretaries have usually quite enough to do in other directions and the preparation of matter for publication is a special job.

The **formal accounts of meetings** usually sent, briefly summarising lectures, and mentioning who presided, who proposed votes of thanks to authors, etc., are quite useful for purposes of record. Filed at headquarters, they enable officers to keep touch with what is going on. But, from a journalistic standpoint, this is not quite what is wanted. The publication, as they stand, of such records in *Light and Lighting* would make very dull reading! As a supplement to formal reports it would help us to receive short notes bringing out **striking or interesting facts or ideas** dealt

with in papers or discussions, or mentioning local activities of I.E.S. members —anything, in short, that is **really news.**

My attention has been drawn to statements in the daily Press that **electric filament lamps** are tending to **burn out more quickly** than they used to do, and suggestions that this may be due to the **"cuts"** in electricity. I question, myself, whether there is much in this idea. Habitual over-running of lamps would certainly tend to shorten their life, but this seems to be the very last thing to expect from supply undertakings in present circumstances; pressure is much more likely to fall below the nominal value, with resultant diminution in light, but, if anything, extension in life. Sudden violent fluctuations up and down might shorten life, but in my experience one does not often meet with this but rather gradual declines and recovery.

Apparently makers are sceptical, though in one case there is an offer to examine and report on lamps that have failed to stay the course. This rather seems to be asking for trouble—unless the idea is to trace makes of lamps below the average. I suspect that **the source of the lamps** is, in fact, the most important consideration. Those of unknown make, purchased over the counter at apparently cheap prices, may well cause disappointment.

I have more than once received inquiries for books and papers dealing with **hospital lighting.** There seems to be very little up-to-date information on this subject, and this is only one amongst several instances of requests for detailed information on special aspects of lighting. Such information naturally cannot be found in general text books. Now that we have available the standard text book by Dr. Walsh and other similar general treatises, either new or under revision, there seems a need for a series of **handbooks on special phases of lighting,** all of moderate size and subject to frequent revision so that they may be kept thoroughly up to date.

Some time ago I commented on the extreme difficulty of ascertaining when **taxicabs** at some little distance are **disengaged**—especially at night. One is glad to notice, therefore, the introduction of a prominent illuminated sign **"For Hire"** mounted above the roof. This great improvement has only been applied to a few cabs as yet, but one hopes it will soon become general.

I have been asked to remind I.E.S. members that advance copies of papers to be read in London may be had from the secretary shortly before the meetings at which they are to be presented.

LIGHT
IN DAILY LIFE
BY J. STEWART DOW
(Price 4s. 10d., Post Free)

Light and Civilisation—Light and Sight—The Lighting of the King's Highway — Light and Transport—Light and Work—Light: the Salesman—Light in the Home—Light and Entertainment — The Marvels of Invisible Light—Light in Time to Come

Copies obtainable from
The Illuminating Engineering Publishing Co., Ltd.,
32, Victoria St., London, S.W.1

Reviews of Books and Publications Received

I.E.S. Lighting Handbook. Pp. 841 + viii with many diagrams and illustrations. (The Illuminating Engineering Society, New York, N.Y., U.S.A.; Price $7.50.)

This is a book of reference, which contains a wealth of information on all lighting matters and which compels admiration, both for those who conceived the idea of bringing together such a mass of authentic detail and for those who carried through the immense task of editing it and making it easy for the reader to consult with satisfaction. It is necessarily a composite work and is prefaced with an imposing list of 132 contributors, including many names which are familiar to every lighting engineer (though there is one prolific writer whose name is absent).

The book is divided into 16 sections, the first nine being devoted to principles and the remaining seven to practice, though these terms are not very clearly indicative of the subjects included under them. For instance, the first division contains sections on light sources, light control and daylight, in addition to those on more fundamental matters such as light production, vision, photometry, colour and lighting calculation. The division described as dealing with practice is, perhaps more aptly, termed the "Application division" in the book itself. A very long section deals with the lighting of interiors of all kinds while other sections are concerned with exterior lighting, sports lighting, transportation (including street) lighting and other fields of lighting application. Finally, there is a 51-page appendix of tabular matter which cannot be appropriately included in the body of the book and 187 pages in which half that number of manufacturers describe the services they can offer the lighting engineer or the user of lighting equipment. Each of the 16 sections is paged separately and concludes with a very lengthy bibliography though, as perhaps might be expected, the references are almost entirely to American literature. The treatment throughout naturally reflects the American point of view and this must always be carefully borne in mind by the reader in this country. For example, the section on lighting calculations has pages of tabular matter for the calculation of brightness ratios in interiors, whereas the section on daylight is very brief and the treatment of street lighting might not unfairly be described as "sketchy." Nevertheless, there is little doubt that every lighting engineer, whatever his particular interest, will find this book of the utmost value and will most heartily congratulate the American Illuminating Engineering Society on having performed a great service for all who are engaged in furthering the cause of better lighting.

The Technique of Stage Lighting, by R. Gillespie Williams. (Sir Isaac Pitman and Sons, Ltd.; pp. 194 + xiv, with 6 colour plates. Price 21s.)

It is strange that, in spite of the great developments which have taken place comparatively recently in stage lighting, there should be so few books on the subject. Mr. Gillespie Williams is no stranger to lighting engineers, and many will remember the most entertaining talk and demonstration that he gave to the Illuminating Engineering Society some five years ago. He is a master of both the art and the craft, and his book is further evidence of this. It is conveniently divided into four sections dealing respectively with fundamentals, with sources of light, lighting apparatus and auxiliary equipment, with the art of stage lighting and with the practical problems which arise in lighting a stage production.

The first section is naturally of less interest than the others to the professional lighting engineer, but the second, occupying more than half the book, will be a real eye-opener to those many who have no idea of the multiplicity of apparatus now employed in any important

production in a large modern theatre. This section includes an extensive list of stage terms with—mercifully—explanations. (What, for example, is a "boomerang" or a "tormentor"?). In the other two sections the author takes the reader (literally) behind the scenes and shows him some of the secrets of the successful use of the lighting equipment described earlier. There is no doubt that everyone who is fortunate enough to buy, borrow or steal a copy of this book will endorse what Mr. Jack Hulbert has written in his preface, viz., "Mr. Gillespie Williams has produced a valuable textbook . . . and it should prove a very practical contribution to the technical improvement of stage production."

Electrical Engineering; Scope, Training and Prospects, by Frederick W. Purse. (*Southern Editorial Syndicate, Ltd., London*, 1947; *pp.* 104. *Price* 5*s. net.*)

This little book is something new. It does not instruct in electrical engineering, but gives a general survey of the industry, the qualifications demanded therein, and the opportunities it offers. Mr. Purse is well qualified for this task. He was formerly Chief Engineer of the London and Home Counties Joint Electricity Authority. He has been a vice-president of the Institution of Electrical Engineers and president of the I.M.E.A. And it may be aded that he was at one time on the I.E.S. Council. After reviewing briefly various aspects of electrical engineering, manufacturing, operative, executive and manual, he discusses fully the nature of preliminary preparation and alternative systems of technical taining. He gives useful information on such bodies as the I.E.E., which is naturally of great importance to all embarking upon field work. In subsequent chapters, having dealt with "study," he reviews ultimate "rewards," explaining the various openings available, the remuneration, conditions of service, and possible future developments. Throughout his book Mr. Purse continually emphasises the need for careful planning and deliberate decision ("drifting is fatal"), and gives valuable help in suggesting other sources of information and guidance. The book should be carefully studied by all those who think of making electrical engineering their career. Some day, perhaps, we may have a similar volume covering the field of illuminating engineering.

Personal Notes

Mr. Robert Maxted, who is now back in England as a Consultant, plans to take up a partnership in Auckland, New Zealand. Mr. Maxted, who has served on the I.E.S. Council and has read papers before the Society, is well known in the lighting industry through his association with the Lighting Research and Development Section of the B.T.H. Research Laboratories.

We learn with pleasure that Mr. E. G. Phillips, the senior partner of E. G. Phillips, Son and Norfolk, consulting engineers in Nottingham and a leading member and past chairman of the I.E.S. Nottingham Centre, has been appointed an Officer of the Order of the British Empire.

I.E.S. Transactions

Readers may like to know that a limited number of copies of the following papers which were published in the I.E.S. Transactions during 1947 are still available:—

Colour in Illuminating Engineering, by W. D. Wright.

Railway Lighting, by A. Cunnington and G. W. Golds.

The Brightness and Legibility at Night of Road Traffic Signs, by J. S. Smyth.

International Relations in Illuminating Engineering, by N. A. Halbertsma.

The Reflexion Factor of Glass, by J. G. Holmes.

Lighting in Coal Mines, by J. Ivon Graham.

The Training of the Illuminating Engineer, by J. W. T. Walsh.

An Analysis of the Light Distribution of Street Lanterns, by J. M. Waldram.

Hot Cathode Tubular Fluorescent Lamp Circuit Analysis, by E. Wood.

Decoration and Industrial Lighting, by J. H. Nelson.

Copies of these papers may be obtained from the Secretary, the Illuminating Engineering Society, 32, Victoria Street, London, S.W.1, price 1s. 6d. per copy to members of the I.E.S., 5s. per copy to non-members.

Lighting In a Public Baths

The installation of a new lighting scheme, using mainly fluorescent lamps of both the cold cathode and hot cathode types makes Lime Grove Baths, Hammersmith one of the best lighted public baths in this country, or even in Europe.

The largest and most interesting part of the installation is in the first-class bath, which measures 120ft. x 50ft., and is dominated by a large laylight 35ft. above floor level running the whole length of the bath.

In order to take full advantage of this, the laylight was re-glazed with small hammered glass and 32 G.E.C. cold cathode triple tube units, housing Osram warm-white fluorescent lamps, were installed in four rows 4ft. above the laylight. These units were provided with reflectors which were supplied and fitted by Hammersmith Electricity Dept.

The intensity from this lighting alone is 8/10 lumens per sq. ft. at bath level. Additional lighting is provided under the balcony and in the cabins by 25 5ft. Osram warm-white lamps housed in channels having ribbed "Perspex" troughs.

A particularly attractive effect has been obtained in the corridor leading to this bath. Each alternate bay is lighted by Osram twin warm-white lamps in channel units, and, the ceiling being painted pale primrose, the effect is of alternate stretches of primrose and pale-pink ceiling, the pink being due to the warm-white lamps.

The second-class bath measures 115ft. x 45ft. and is lighted by Osram warm-white lamps in 20 G.E.C. cold cathode triple tube units arranged in two rows. These are mounted at 25ft. and give an intensity at bath-level of 7 lumens per sq. ft.

All main corridors are lighted by Osram 4ft. warm-white lamps in G.E.C. channel units. The ticket office and refreshment room have 5ft. lamps in similar fittings.

Five-foot daylight lamps in trough reflectors are used in the public washhouse and laundry, while tungsten lighting is to be found on the staircases and in the dressing rooms, waiting rooms and boiler house.

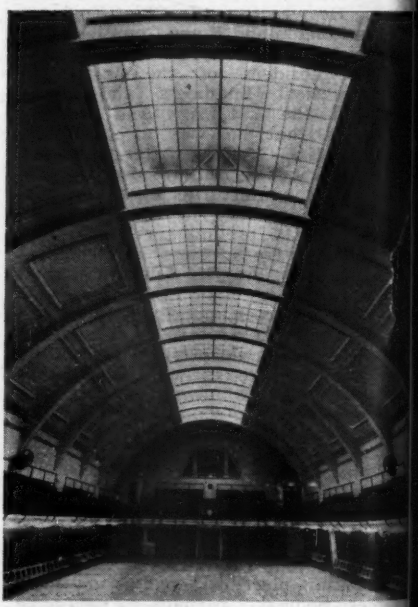
Lectures on Illumination

It is announced that a special course of five lectures on recent developments in illumination and photometry is to be given by Mr. J. M. Waldram at the Sir John Cass Technical Institute (Jewry-street, Aldgate, London, E.C.3). The lectures will be held weekly on Mondays from 6.30 to 7.30 p.m., beginning on Monday, January 19.

The syllabus for the lectures is as follows:—

I. "The Sense to be Served."—Seeing, visibility, task analysis, the I.E.S. Code.
II. "The Available Tools—Lamps."—Tungsten, sodium, mercury, and fluorescent lamps.
III. "The Available Tools—Lighting Equipment Design."
IV. "Some Recent Problems."—Interior lighting, street lighting, aviation lighting.
V. "Recent Photometric Apparatus."

The fee for the complete course is 10s.



View of the first-class bath at Lime Grove, Hammersmith.